

Morphological disparity in the evolution of tenrecs

1 Overview

My research is an investigation of evolutionary patterns in tenrecs (Afrosoricida, Tenrecidae). The original aim of my project was to quantify both morphological and ecological diversity within the tenrecs family (disparity) and their similarities to other small insectivorous mammals (convergence). I have almost completed the first part of this plan; please see the paper draft "Cranial morphological disparity within the adaptive radiation of tenrecs (Afrosoricida, Tenrecidae) is no greater than expected by chance" which accompanies this report.

After much careful consideration and seeking advice from many different sources, I have decided to convert my project to a Masters by research thesis rather than PhD. My plan is to use the attached paper as the basis for the thesis along with a more extensive introduction and conclusion as well as a more detailed methods section.

I have not made this decision lightly but I believe that it is the best option for me. If I were to continue with my project then officially I would have one year left to complete the PhD. However, realistically I know that it would take much longer. My plan was to have seven chapters: four of which would be paper driven along with an introduction, data collection and conclusions. The accompanying paper would be one of the four paper-driven chapters. The others would be 1) a review of methods of quantifying convergence, 2) quantifying morphological convergence among

tenrecs and other small mammals, 3) testing whether morphological convergence is predicted by ecological similarity. In my first year report in November 2013 (see attached document) I included an outline for a further chapter based on behavioural studies of echolocatory capabilities in shrew-type (*Microgale*) tenrecs. Natalie and I travelled to Madagascar in April of this year but unfortunately our experiments were unsuccessful so I was unable to collect sufficient data for this chapter.

Completing this PhD thesis plan would be more than a simple extension of the work that I'm doing already. I would need to master different statistical techniques for quantifying convergence to a sufficient degree to be able to both use the methods for my own research and to critique them in a review. Furthermore, I would need to collect a new data set of ecological variables for my species and then apply different methods for assessing the evidence for ecological convergences among tenrecs. I understand that it's common to feel overwhelmed by a PhD half way through the project. However, my decision to switch to a masters instead is not purely a matter of being overwhelmed or unwilling to approach hard work. Despite the volume of work remaining I know that I do have the ability to complete the project if necessary. However, my strengths and interests lie outside traditional research and I don't wish to continue struggling to finish a piece of work to which I'm not suited.

I am extremely grateful to the committee for all of your help and guidance over the past two years. I feel especially thankful and fortunate to have had such a dedicated supervisor: I am so grateful to Natalie for her constant support, mentoring, teaching and advice.

In this report I outline the current progress on my paper, plans for how I will develop the work into a complete Master's thesis and a brief summary of the other academic work completed since my last report. I would be very grateful for advice about what's the best way to approach this transition. My current plan is to contact the IRC this month (September) to tell them that I would like to terminate my contract and that they should close my research account with college.

My fees are covered by my final year of Schols so I would like to re-register

as a student for this academic year. My aim is to complete and hopefully submit the paper by mid-October and then work it up into at least a first draft of a full thesis by mid November to be ready to submit before the end of the semester. However, if I submit the thesis before Christmas would that make me ineligible to re-register as a continuing student in January? If so then I would prefer to wait and submit my thesis after re-registering. These options are pretty much equivalent in the long term because, all going well, my year of graduation from the masters would be 2015 either way. Therefore I would be grateful for advice on what's the best way to ensure that I'm eligible to remain a student for the full 2014/2015 academic year.

2 Progress on the accompanying paper

Chapter 3: Quantifying morphological disparity in tenrecs *Journal targets: Journal of Evolutionary Biology, PLoS ONE, Journal of Mammalian Evolution?* , submit August 2014.

This is the chapter which corresponds to the draft paper that accompanies this report. I have completed the majority of the work for this paper.

Given that tenrecs are often cited as an example of a phenotypically diverse group (e.g. Olson, 2013), my finding that morphological disparity is no greater than expected by chance was unexpected. Therefore I'm currently checking the code that I used for the calculations and simulation studies to ensure that the results are accurate rather than just artefacts of a fault in the methods.

I would very much welcome any comments on the draft paper, particularly if you have suggestions for how I could make the overall story clearer and more interesting to a wide audience. My aim for the paper is that it's a test of a broad principle; the importance of testing our assumptions about phenotypic variation in adaptively radiated groups, with tenrecs as a specific example rather than a more limited study of morphological variation in a particular group of mammals.

Dr. Steve Goodman, an expert in tenrec ecology and evolution, has expressed an interest in collaborating on the paper so I will send it to him

for comments before submitting to the Journal of Evolutionary Biology by the end of the summer.

3 Extending the paper into a thesis

This is a general introductory chapter. I will include brief outlines of convergence and disparity and why they are useful and interesting measures of evolutionary diversity. I will discuss convergence within the context of what it tells us about the repeatability of evolution (e.g. Blount et al., 2008) and disparity within the framework of how it relates to the study of adaptive radiations (Losos & Mahler, 2010). In particular, I will stress the importance of taking quantitative approaches to studying each of these patterns rather than relying on subjective estimates. I will follow these discussions with a brief introduction of tenrecs and the long-standing interest in the apparently high morphological and ecological diversity within the family and the similarities among tenrecs and other distantly related mammal species (e.g. Eisenberg & Gould, 1969; Soarimalala & Goodman, 2011; Olson, 2013).

Along with the conclusions (chapter seven), this will be the last chapter that I write because it will be easier to introduce the rest of the thesis once I know how those chapters have taken shape.

Chapter 2: Data collection

My thesis will be based on two main data sources; morphological and ecological. The questions addressed in chapters three, five and six will all be based on these same data sources. Therefore, rather than repeating the information in multiple sections, I will combine my data collection methods into this single chapter which I can then refer to in the rest of the thesis. I have collected all of the data and completed most of the writing for the morphological section of this chapter. I haven't started the sections relating to the ecological data but I will work on this aspect as I collect the relevant data over the coming months (see chapter six below). I will finish writing the chapter by this September.

Chapter 7: Conclusions

This chapter will summarise the importance of taking a quantitative approach to studies of evolutionary diversity (morphological and ecological) among species groups. In particular I will highlight the need to apply existing methods to new groups of species which are usually not as well studied as the groups that are used to develop such metrics. I will also include suggestions for future directions, particularly in the area of addressing the functional importance rather than pure description of convergent traits (Losos, 2010). I could also include mention my unsuccessful fieldwork experiments here (see below) as another potential basis for future work.

4 Other work

1. Publications since the November 2013 report

Finlay, S., Goodman, S.M., Cooper, N. Significant levels of morphological disparity in the adaptive radiation of tenrecs (Afrosoricida, Tenrecidae). *In prep. To be submitted to the Journal of Evolutionary Biology*

Healy, K., Guillerme T., **Finlay, S.**, Kane, A., Kelly, S.B.A., McClean, D., Kelly, D.J., Donohue, I., Jackson, A.L. and Cooper, N., 2014. Ecology and mode-of-life explain lifespan variation in birds and mammals. *Proceedings of the Royal Society B*, 281(1784)

2. Presentations

This summer I gave my first oral conference presentations at the Evolution conference in Raleigh, North Carolina (June) and the British Ecological Society Macroecology conference in Nottingham (July).

3. Reviewing

So far I have reviewed a journal article (International Journal of Primatology) and a book chapter on phylogenetic comparative

methods for quantifying convergence. I hope that I will get some more reviewing practice once I start publishing my own papers.

References

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- Olson, L.E. 2013. Tenrecs. *Current Biology* **23**: R5–R8.
- Soarimalala, V. & Goodman, S. 2011. *Les petits mammifères de Madagascar*. Guides sur la diversité biologique de Madagascar. Association Vahatra, Antananarivo, Madagascar.